Device for rotationally driving a turbine for stirring the gases inside a furnace

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Inventor:	GILLES RIGOLLET; JEAN-PAUL GENEVOIS
Applicant:	CREUSOT LOIRE (FR)
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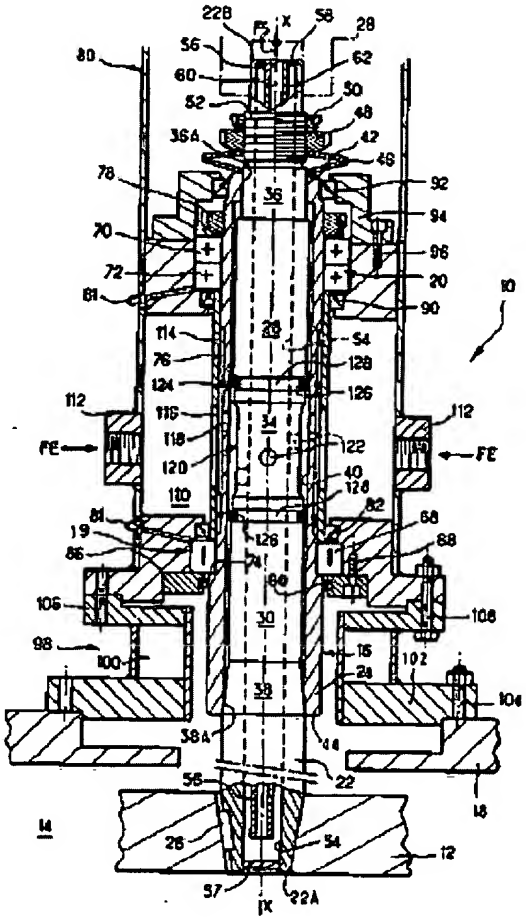
Abstract of **FR2684141**

The device includes a rotary member (16) comprising a shaft (22) passing through the arc (room) (18) of the furnace, connected to the turbine (12), and a sleeve (24) fitted over the part of the shaft (22) outside the furnace. The sleeve (24) is mounted so that it can rotate in rolling-contact bearings (19, 20). The shaft (22) is centred with respect to the sleeve (24) by complementary cylindrical (36, 36A) and conical (tapered) (38, 38A) surfaces formed on the shaft (22) and the sleeve (24). The axial positioning of the shaft (22) with respect to the sleeve (24) is provided by these same complementary conical surfaces (38, 38A) and a Belleville washer (46) located between one end of the sleeve (24) and a nut (48) screwed onto the shaft (22). Application to stirring up the gases inside a furnace used in the iron and steel industry.



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The present invention relates to a driving mechanism in rotation of a turbine of mixing of gases inside a furnace.

It applies in particular to the turbines of mixing equipping the furnaces used in the iron and steel industry.

The steel parts, in particular the large forgings or the heavy plates must undergo heat treatments by reheating at high temperature in large-sized furnaces.

To ensure the homogeneity of the reheating of the parts, it is known to brew hot gases contained in the furnaces. This mixing is carried out usually by means of turbines of which each one is connected to a driving mechanism in rotation including/understanding a rotary tree, crossing the arch of the furnace, connected to the turbine and coupled with an engine of drive. This tree is assembled rotary in housing bearing located above this vault.

This technique presents a disadvantage due to the fact that <RTI ID=1.1> /RTI< temperature> very high of the furnace (higher than <RTI ID=1.2> 700 " C)< /RTI> quickly deteriorate the turbines and the driving shafts. Those must thus be frequently dismounted to be replaced. When one reassembles a new tree and a new turbine, it is necessary to carry out a dynamic balancing of the rotary unit that <RTI ID=1.3> one< /RTI> has just installed, which makes for a long time the furnace inalienable.

The goal of this invention is to propose a driving mechanism in rotation of a turbine of mixing of furnace which has one long lifespan and whose tree connected to the turbine of mixing can be replaced without it being necessary to carry out, after assembly of a new tree, a new dynamic balancing of the whole of the driving mechanism.

For this purpose the invention has as an aim a driving mechanism in rotation of a turbine of mixing of gases inside a furnace, standard including/understanding a rotary body connected to the turbine, crossing a wall delimiting the furnace, assembled rotary in stages laid out outside the furnace, characterized in that the rotary body includes/understands a sleeve of tubular general form, gone up rotary in the stages, laid out outside the furnace, a tree connected to the turbine, crossing the wall of the furnace, of which the external part with the furnace is assembled inside the sleeve, and of the means of centering and axial positioning of the tree compared to the sleeve.

According to other characteristics of the invention: - the means of centering of the tree compared to the sleeve include/understand a cylindrical surface and a conical surface, spared on the contour of the internal surface of the sleeve cooperating with the complementary surfaces spared on the external surface of the tree, complementary cylindrical surfaces being laid out at the end of the sleeve furthest away from the furnace, called distal end, and complementary conical surfaces being laid out at the end of the sleeve opposed to the preceding one, called proximale end, so that the base of the conical surface of the sleeve delimits the edge of the proximale end of this one - the means of axial positioning of the tree compared to the sleeve include/understand the aforementioned complementary conical surfaces and of the average rubber bands forming support, carried bytree, in contact with the edge of the distal end of the sleeve - the average rubber bands of axial positioning of the tree compared to the sleeve comprise at least a Belleville spring
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washer laid out between the distal end of the sleeve and a unit including/understanding a nut and a counter-nut fixed on a threaded part of the tree; - the tree includes/understands means of cooling; ; - the means of cooling of the tree include/understand means of supply coolant connected to a cylindrical hole bored along the tree, coaxial with this one, the interior volume of the hole being divided by a tubular wall into two coaxial rooms of cooling, one central and the other annular one, the annular cooling chamber being connected to the means of supply coolant and the central cooling chamber being connected, by a first end, with the annulus and, by one second end opposed to the preceding one, means of repression of the coolant or emerging with the free air - means of supply coolant include/understand a fixed room of supply fluid of refroi1> rotary< /RTI> - the coolant is compressed air.

The invention now will be described more in detail compared to the single annexed figure which is a longitudinal cross-section of a device according to the invention.

One sees on this figure a device 10 of swing drive of a turbine 12 of mixing of internal gases of a furnace 14 at high temperature for the heat treatment of steel parts. This driving mechanism 10 includes/understands a rotary body 16 connected to the turbine crossing a vault 18 of the furnace 14. This rotary body 16 turns around an axis X-X laid out appreciably vertically.

Device 10 of swing drive of the turbine also comprises housing bearing 19,20 in which the rotary body 16 is assembled. These stages will be described later on.

The rotary body 16 includes/understands a tree 22, crossing vault 18 of the furnace, and a sleeve 24 fixed on the external part with the furnace of the tree 22. This sleeve 24 is assembled rotary in stages 19,20.

The 22A end of the tree 22 laid out inside the furnace is of form conical and carries turbine 12 interdependent in rotation of the tree 22 by means of a key 26.

The external 22B end with the furnace of the tree 22 is coupled with an engine of drive of the known type, not represented on the figure, by means of a body of coupling 28 represented in mixed features on the figure.

The external surface of the part of the tree 22 placed inside the sleeve 24 axially includes/understands two cylindrical surfaces 28,30 laid out on both sides of a throttling 34 spared on the tree 22. These cylindrical surfaces 28,30 constitute guide tracks for the installation of the tree 22 in the sleeve 24.

The external surface of the tree 22 also comprises a cylindrical surface 36 and one conical surface 38 intended for the centering of the tree 22 compared to the sleeve 24. These surfaces of centering 36,38 cooperate with surfaces 36A, 38A of complementary form spared on surface interns 40 of the sleeve 24. The cylindrical surface of centering 36A of the sleeve 24 is laid out at its end 42 furthest away from the furnace, called distal end. The conical surface of centering 38A of the sleeve 24 is laid out at its end 44 opposed to the preceding one, called proximale end, in such way that the base of this conical surface 38A delimits the edge of the end proximale 44.

Complementary conical surfaces 38,38A of the tree 22 and the sleeve 24 also constitute means of axial positioning of the tree 22 compared to the sleeve 24. These means of axial positioning include/understand moreover of average rubber bands 46, carried by the tree 22, in contact with the edge of distal end 42 of the sleeve. These average rubber bands include/understand a Belleville spring washer 46 laid out between the distal end 42 of the sleeve and a unit including/understanding a nut 48 and one counter-nut 50 screwed on a threaded part 52 of the tree 22.

The tree 22 is bored over all its length of a cylindrical hole 54, of axis confused with that of the tree 22, in which coaxialement a tube 56 is laid out.

The end 22A intern with the furnace of the tree 22 is sealed by means of a stopper 57 welded onto the tree. An end of tube 56 is connected at the external 22B end with the furnace of the tree 22 by means of a disc 58 welded between the surface of hole 54 and the external surface of tube 56. Tube 56 being a length slightly lower than the length of hole 54 of the tree 22, the loose lead of tube 56 emerges in hole 54 at a short distance of stopper 57 of the end 22A intern to the furnace of the tree 22. The wall of tube 54 delimits thus, inside hole 54, two rooms 60,62 coaxial. A first central room delimited by the internal surface of tube 56 communicates by the loose lead of tube 56 with one second annulus 62 arranged between tube 56 and surfaces it delimiting hole 54.

The annulus 62 of hole 54 is connected to means of supply coolant which will be described later on.

One now describes the housing bearing 19,20 in which rotary the sleeve 24 is assembled. A first stage 19 inferior, by considering the figure, comprises a roller bearing 68. Second stage 20 superior comprises two ball bearings 70,72.

Bearings 68,70,72 are positioned axially compared to the sleeve 24 in the following way.

The roller bearing 68 is positioned between a thrust 74 spared on the external surface of the sleeve 24 and one spacing sleeve 76 of spacing of this roller bearing 68 and of the ball bearings 70,72.

These ball bearings 70,72 are positioned between this spacer 76 of spacing and a nut 78 screwed on a threaded part of the external surface of the sleeve 24.

Stages 19,20 are assembled in a tubular body 80, forming a shell of the means of dynamic positioning of the sleeve 24, and are welded onto the wall of this body 80. Greasing devices 81 intended for the lubrication of the bearings emerge outside body 80 and cross stages 19,20 to the bearings.

One now describes means of sealing of stages 19,20.

The means of sealing of the lower stage 19 comprise, <RTI ID=6.1> of< a /RTI> leaves, a first O ring 82 laid out between this lower stage and external surface of the spacing sleeve 76 and, in addition, a second O ring 84 laid out between external surface of the sleeve 24 and one flask 86 fixed by screws 88 at stage 19.

The means of sealing of the higher stage 20 comprise, on the one hand, a first O ring 90 laid out between this higher stage and external surface of the spacing sleeve 76 and, on the other hand, a second O ring 92 laid out between external surface of the sleeve 24 and one flask 94 fixed by screws 96 at the higher stage 20.

The unit consisted body 80 and stages 19,20 is assembled on vault 18 of the furnace via a radiator tank of general reference 98. This radiator tank includes/understands an annulus 100 laid out between a first flask 102 fixed on vault 18 of the furnace by pins 104, and a second flask 106 on which the lower stage 19 by bolts 108 is fixed.

One now describes the means of supply coolant. In the example the coolant used describes is air compresses.

The wall of body 80, the sleeve 24 and two stages 19,20 delimit an annular fixed room 110 which is connected to a feeding attachment in compressed air of known type, not represented on the figure, by means of ends of connection 112. The compressed air penetrates in the room fixes 110 while passing by ends 112 as that is indicated by the arrows FE of the figure.

The wall of the sleeve 24 comprises a throttling 114 laid out appreciably compared to the room fixes 110. With the right of this throttling 114, the spacing sleeve 76 is provided with openings 116 allowing the passage of the cooling air. With the right of these openings 116, the sleeve 24 is provided with holes of passage 118 making it possible the air to reach in a rotary cable distribution box 120 delimited by the internal surface of the sleeve 24 and by the surface of throttling 34 of the tree 22. The air arriving in the rotary room 120 is sent in the annulus 62 of cooling of the tree 22 while passing through openings 122 spared through the wall of the tree 22.

Toric seals 124 are laid out between internal surface of the spacing sleeve 76 and external surface of the sleeve 24. The sealing of the rotary room 120 is ensured by O rings 126 laid out in annular throats 128 of the tree 22 on both sides of throttling 34 of this tree.

The cooling air circulates in the annulus 62 of cooling of the tree and penetrates in the central room 60, inside tube 56, by the loose lead of this one. The cooling air is evacuated by the end of tube 56 emerging at the 22B end of the tree,

opposed to the furnace, as that is indicated by arrow FS of the figure. The compressed air is evacuated freely in the atmosphere.

To dismount a turbine, it is enough to disconnect <RTI ID=8.1> 1 'tree< /RTI> 22 of the engine of drive, to remove counter-nut 50, nut 48 and the Belleville spring washer 46 then to withdraw the unit consisted the tree 22 and turbine 12.

To reassemble a new turbine 12, one fixes a tree 22 at new turbine 12, one balances in workshop this unit, and one introduces the tree into the sleeve.

One fixes then the tree by means of the Belleville spring washer 46, of nut 48 and counter-nut 50.

Cylindrical surface 36 and conical surface 38 spared on the external surface of the tree 22 ensure a precise centering of the tree in the sleeve 24. These surfaces 36,38 as well as the Belleville spring washer 46 and nut 48 ensure a static positioning of the tree 22 compared to the sleeve 24.

The Belleville spring washer 46 makes it possible to absorb the differences in expansion between the tree and the sleeve. Indeed, the penetrating tree inside the furnace has tendency <RTI ID=9.1> to warm up< /RTI> and to dilate. The Belleville spring washer 46 makes it possible to catch up with the axial deformation of the tree 22 due to the expansion of this one and to ensure a good contact between complementary conical surfaces 38,38A, respectively spared on the tree and the sleeve.

The sleeve 24 as well as stages 19,20 with bearing being laid out outside the furnace, those are protected from the heat of the furnace and are not subjected to important thermal stresses.

The sleeve not being dismounted during the replacement of the tree, the positioning and the dynamic balancing of this sleeve were not modified.

Consequently, it is not necessary to remake a balancing of the unit consisted the turbine, the tree and the sleeve.

In addition, the circulation of a coolant inside the hollow shaft increases its lifespan considerably.

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CLAIMS

1. Driving mechanism in rotation of a turbine (12) of mixing of gases inside a furnace (14), type including/understanding a rotary body (16) connected to the turbine (12), crossing a wall (18) delimiting the furnace, assembled rotary in stages (19,20) laid out outside the furnace, characterized in that the rotary body (16) includes/understands a sleeve (24) of tubular general form, gone up rotary in the stages (19,20), laid out outside the furnace, a tree (22) connected to the turbine (12), crossing the wall of the furnace, of which the external part with the furnace is gone up inside the sleeve, and of the means of centering (36,36A, 38,38A) and of axial positioning (38,38A, 46,48) of the tree (22) compared to the sleeve (24).

2. Device according to claim 1, characterized in that means of centering of <RTI ID=10.1> 1 'tree< /RTI> (22) compared to the sleeve (24) includes/understands a cylindrical surface (36A) and a conical surface (38A), spared on the contour of the internal surface of the sleeve (24) cooperating with the complementary surfaces (36,38) spared on the external surface of the tree (22), complementary cylindrical surfaces (36,36A) being laid out at the end (42) of the sleeve (24) furthest away from the furnace, called distal end, and complementary conical surfaces (38,38A) being laid out at the end (44) of the sleeve opposed to the preceding one, called proximale end, so that the base of conical surface (38) of the sleeve delimits the edge of the proximale end of this one.

3. Device according to the claim 1 or 2, characterized in that the means of axial positioning of the tree (22) compared to the sleeve (24) include/understand the aforementioned complementary conical surfaces (38,38A) and of the average rubber bands (46) formant support, carried by the tree, in contact with the edge of the distal end (42) of the sleeve (24).

4. Device according to claim 3, characterized in that the average rubber bands of axial positioning of the tree (22) compared to the sleeve (24) comprise at least a Belleville spring washer (46) laid out between the distal end (42) of the sleeve (24) and a unit including/understanding a nut (48) and a counter-nut (50) fixed on a threaded part (52) of the tree (22).

5. Device according to any of the preceding claims, characterized in that the tree (22) includes/understands of the means of cooling (54).

6. Device according to claim 5, characterized in that the means of cooling of the tree (22) include/understand means of supply coolant connected to a cylindrical hole (54) bored along the tree (22), coaxial with this one, the interior volume of the hole (54) being divided by a tubular wall (56) into two coaxial rooms (60,62) of cooling, one central (60) and the other annular one (62), the annular cooling chamber (62) being connected to the means of supply coolant and the central cooling chamber (60) being connected, by one first end, with the annulus (62) and, by one second end opposed to the preceding one, means of repression of the coolant or emerging with the free air.

▲ top 7. Device according to claim 6, characterized in that the means of supply coolant include/understand a fixed room (110) of supply coolant, surrounding external surface of the sleeve (24), and a rotary room (120) spared between the external surface of the tree (22) and the internal surface of the sleeve (24), these rooms (110, 120) as well as the room (62) annular of cooling of the tree (22) being connected in series by openings (118,122) respectively crossing the wall of the sleeve (24) and the wall of the tree (22).

8. Device according to claim 7, characterized in that the fixed room (110) of supply coolant surrounding external surface of the sleeve (24) is laid out between the stages (19,20) and an envelope (80) containing these stages (19,20) and the external part with the furnace of the rotary body (16).

9. Device according to any of claims 6 to 8, characterized in that the coolant is compressed air.